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APPLICATION NO.	FILED DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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MCKEE, VOORHEES & SEASE, P.L.C. ATTN: PENNSYLVANIA STATE UNIVERSITY 801 GRAND AVENUE, SUITE 3200 DES MOINES, IA 50309-2721				
			EXAMINER SAGAR, KRIPA	
			ART UNIT 1754	PAPER NUMBER

DATE MAILED: 01/21/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/032,649

Applicant(s)

WEISS ET AL.

Examiner

Kripa Sagar

Art Unit

1756

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply**ASHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.**

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 07 November 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-59 and 69-72 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-59 and 69-72 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 27 October 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s) _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Response to Amendment

1. The amendment filed with the request for continued examination has been entered. Claims 1,54,69 have been amended. Claims 71-72 have been newly added. No new matter has been introduced by the amendment. Claims 60-68 have been cancelled. Claims 1-59,69-72 are under consideration.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Or

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 1,54,69 and 71 are rejected under 35 U.S.C. 102(b) as being anticipated by US Pat. 6436615 to Brandow et al.

Claims 1 54, 69,71 disclose a method of patterning a substrate using *selective* surface chemistry wherein: a surface is at least partially covered with a molecular layer having a first functionality; *selectively* reacting the "internal bonds" to form a stable layer/pattern with a second functionality.

Brandow teaches that "surface reactivity templates" are known in prior-art (1;31-56). The reactivity template is formed by "*selective modification*" of a thin film on the surface of a substrate; the chemical modification is carried out by irradiation (2;58-64). Brandow's invention comprises providing a functional group on a substrate surface, exposing parts of the surface to actinic radiation to convert the exposed regions to photoproducts; the photoproducts are reactive to other functional groups (1;67 – 2;25). Brandow discloses patterning of molecular layers (Fig.1-3) that include positive and negative tone patterns. In one embodiment the reaction of the first functional group forms a second functional group by photolysis (Fig.2A). The second functional group is receptive to grafting.

4. Claim 1 is rejected under 35 U.S.C. 102(b) as being anticipated by US Pat. 5079600 to Schnur et al.

Schnur teaches coating a substrate with a monolayer of radiation reactive material; patternwise exposing the material to form spatially spaced first and second areas of different reactivities that are stable; selectively adding another material to one of the areas (2;46-55). The different reactivity areas comprise different chemical moieties (8;27-31).

5. Claim 1 is rejected under 35 U.S.C. 102(b) as being anticipated by US Pat. 5514501 to Tarlov

Tarlov teaches forming a thiol SAM on Au; selectively breaking internal bonds by patterned irradiation and addition of a second thiol layer to the photoreacted areas. (Fig.1-3). This is similar to the example cited by Applicant (instant specification; fig.1).

6. Claim 1 is rejected under 35 U.S.C. 102(b) as being anticipated by the non-patent publication of Lercel et al.

Lercel teaches a method of patterning a substrate by coating the surface with a monolayer of alkylthiol or siloxanes; patterned exposure of the monolayer with scanning tunneling microscope to modify the chemical functionality of the terminal group (p.3663-3667). The monolayers may be selected for diverse substrates. It teaches that the organic component of the monolayer may be tailored to suit the specific application. (p.3663; Introduction).

7. Claim 1 is rejected under 35 U.S.C. 102(e) as being anticipated by the non-patent publication of Maoz et al.

Maoz teaches covering the surface of a substrate with a plurality of (NTS – silane) molecules and selectively reacting the internal bonds on the molecules to form a second functional group. An atomic force microscope tip is used to oxidize the terminal vinyl group. A second silane (OTS) is adsorbed in the modified areas (Fig.1).

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. Claims 2 – 53,55-58,70,72 are rejected under 35 U.S.C. 103(a) as being unpatentable over Brandow in view of Keana and further in view of the non-patent

publication of Nyffenegger and co-worker ("Scanning Probe Microscope", Chem. Rev. v97(4),(1997), pp.1195-1230).

The claims recite methods of forming the patterned layers using scanning probes and diverse energy sources, the substrates used as supports for the layers and the nature of the layers.

In additions to the teachings discussed above, Brandow teaches selective modification of a *surface* or a *thin film* covering the surface. The modification is a *chemical reaction* of the molecules on the surface, by *irradiation*. The process *may* include a *mask* or *direct writing* may be used. The irradiation may be carried out using *UV light*, *ion beam* or *soft X-rays*. (2;50-3;4). Other sources such as *electron beams* are also viable (4;53-61). Direct chemical reaction is also known (3;19-27). Substrates such as *glass* (fused SiO₂) and *Si* have been used for support (12;29-31). Scanning Tunneling (STM) and Atomic Force Microscopy (AFM) are used for selective patterning (3;5-32). The molecular layer may be attached to the substrate surface through diverse bonds that include *chemical attachment* and physisorption (3;58-64).

Brandow does not teach the use of scanning probe tools (SPM), thermal imaging, diverse substrates and geometric patterns. It does not specify nanolithography or cross-linking of functional groups.

Keana teaches diverse *substrates* that may be used for chemical modification (2; 27-35). The molecular layers may be modified by radiation, including electrons, photons and *heat* (2;36-46). The process may use a *mask* or *direct scan* (7;7-29). The process is

used to form *geometric patterns* including *stripes* and nano-scale spheres (fig.1,3).

Keana teaches forming functional groups that are *cross-linkable* by photons (20;48-57).

Keana does not teach the use of scanning probes for photon irradiation. This is a well-developed art as shown by the review of Nyffenegger. The lithographic application of Near Field Scanning Optical Microscopy (NSOM) is reviewed at length (p. 41) with the teachings of Bottomley particularly relevant to the claims.

It would have been obvious to one of ordinary skill in the art to combine the teachings of Keana and Bottomley with those of Brandow because the Keana's teachings are in an analogous art and it teaches that its methods have wide applicability and can be carried out in a single step (2; 12-18); Bottomley teaches that scanning optical lithography using proximal probes is known in prior art and may be successfully used in patterning very thin films of conventional and unconventional resists (p.41).

Response to Arguments

10. Applicant's arguments presented 11/7/03 have been considered but are not convincing.

Referring to Keana's teachings, Applicant concludes that : Keana does not teach "selecting at least one internal bond from the plurality of molecules". Applicant goes on to argue that the instant invention allows nanoscale patterning that are chemically and spatially precise which Keana's process does not allow.

Applicant's arguments and interpretation of the term "selecting an internal bond" while interesting, are not persuasive. There is nothing in the disclosure which supports the interpretation offered by the Applicant. Applicant does not disclose how the bond to

be reacted is selected. The bond to be reacted would depend on the molecule comprising the "plurality of molecules" in the SAM layer. The chemical specificity arises solely from the selection of the SAM layer applied to the substrate surface (see instant specification #0035) which states that the selection of the molecule depends on the functionality desired. There is no selection of a particular bond within the molecule.

With reference to the argument regarding precision, Examiner notes that this is not recited in the claim.

In arguing against the teachings of Brandow, Applicant states that it does not disclose the step of "selecting at least one internal bond from the plurality of internal molecules". Brandow teaches all the elements of claim 1 as noted in the rejection above. In addition to the portions of the reference cited in the rejection this may also be understood from reference to Fig.1 alone. A substrate is covered with a monolayer of functionalized molecules of an organosilane; internal bonds of the silane are broken by irradiation in a selective pattern; and another functional molecule is added on the monolayers in a negative tone graft. As shown above Brandow teaches selective modification of the monolayer. Brandow teaches both chemical specificity and spatial resolution that have been argued by the Applicant but not included in the claims.

Conclusion

11. As stated in the earlier rejections the *disclosure and the claims* are too generic to be unobvious. As noted in the instant non-specific disclosure: (a) the substrate may be any substrate "including without limitation silicon, silicon oxide, gold, silver, copper,

gallium arsenide, aluminum oxide, titanium oxide, metals, semiconductors, superconductors and insulators"; (b) the molecules may be any molecule "depending upon the chemical functionalization sought" and may be any number of layers thick and need not be uniform (c) the reaction may be brought about by any means including "photons, electrons, ions, excited atoms or molecules, heat, friction, mechanical contact or electrochemistry". Similarly the claims recite forming a plurality of molecules on a substrate surface and selectively reacting the internal bonds. *Almost any chemical reaction on any solid surface would meet the elements of the instant invention as claimed.* However the cited references teach not only all the elements of the claims but also the only specific example provided in the disclosure viz. thiolate patterning on a Au substrate.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kripa Sagar whose telephone number is 571-272-1392. The examiner can normally be reached on M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark F Huff can be reached on 571-272-1385. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.

